Atmosphere Learning Progression
Grades 6-8: GLOBE Protocols Aligned with NASA Resources and NGSS Standards

NGSS Disciplinary Core Ideas Progression of Learning: Building on the concepts developed in grades 3-5 that looked at the relationship between climate and patterns of typical weather conditions over different time scales, students in grades 6-8 will take this a step further as they examine how complex interactions determine local weather patterns and influence climate, including the role of the ocean. Using GLOBE and My NASA Data educators and students will access NASA Satellite Data to examine a variety of interactions within the atmosphere and how these interactions affect the Earth system as a whole. Through the implementation of a series of learning activities and GLOBE protocols, teachers will bring authentic science data collection into their classrooms. (NASA Langley GLOBE Resource Page: www.globe.gov/web/nasa-langley-research-center/home/resources)

NGSS Performance Expectations:
- **MS-ESS2-5:** Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
- **MS-ESS2-6:** Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
- **MS-ESS3-5:** Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

NGSS Science Practices:
Asking Questions and Defining Problems – Ask questions to identify and clarify evidence of an argument. (MS-ESS3-5)
Planning and Carrying out Investigations - Collect data to serve as the basis for evidence to answer scientific questions. (MS-ESS2-5)
Developing and Using Models- Develop and use a model to describe phenomena. (MS-ESS2-6)

NGSS Disciplinary Core Idea:
ESS2.C The Roles of Water in Earth's Surface Processes: The complex patterns of the changes an the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures a currents, are major determinants of local weather patterns.(MS-ESS2-5)
ESS2.D Weather and Climate: Weather and climate are influenced by interactions involving sunlight, ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2
ESS3.D Global Climate Change: Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely i decisions and activities. (MS-ESS3-5)

NGSS Crosscutting Concepts:
Stability and Change
Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS-ESS3-5)
Cause and Effect
Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5)
Systems and System Models
Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS2-6)

GLOBE Alignment: Environmental observations, data collection and learning activities to develop Earth science concepts.

Atmosphere Protocols:
Air Temperature
Clouds
Surface Temperature
Precipitation

Data Investigation Sheets:
Atmosphere Investigation Integrated 1-Day
Atmosphere Investigation Clouds 1-Day
Atmosphere Investigation Surface Temperature

GLOBE Learning Activities:
1. Climate and Latitude: A GLOBE Data Exploration (MS-ESS2-5, MS-ESS2-6, MS-ESS3-5)
2. Modeling the Reason for Seasonal Change (MS-ESS2-6)
3. How do Seasonal Temperature Patterns Vary Among Different Regions of the World (MS-ESS2-6)
4. What are Some Factors That Affect Seasonal Patterns? MS-ESS2-5, MS-ESS2-6)
5. GC1: Your Regional to Global Connection MS-ESS2-5, MS-ESS2-6)
6. Learning to Use Visualizations (All)
7. Draw Your Own Visualization (All)

Cross-Curricular Connections: GLOBE Learning Activities
Math Connection: Calculating Relative Air Mass
Geography Connection: Making a Contour Map
Geography Connection: Weather Tourist: A GLOBE Data Exploration

Guiding Question(s):
1. How can satellite data combined with ground truth observations be used to identify trends and patterns associated with interactions that occur between the atmosphere and other Earth systems?
2. How are regional climates determined by patterns of atmospheric and oceanic circulation? What causes these patterns to occur?
3. Based on evidence that has been collected what factors are associated with the rise in global temperatures over the past century? Which of these factors can be attributed to human impacts? To natural hazards?

NASA Resources: Data and lessons drawn from NASA's Earth science research program.

Extension Learning Activities/Resources:
NASA Climate Change Educational Modules
NASA Earth Observatory World Maps
NASA Wavelength 6-8 List of Learning Resources
MY NASA DATA-GLOBE Digital Earth System Poster

My NASA Data Live Access Server Data Visualization Tool:
Earth System Data Explorer

My NASA Data Variables to Explore:
Air Temperature: Monthly Near-Surface Air Temperature (ISCCP)
Clouds: Monthly Cloud Coverage (CERES TERRA)
Surface Temperature: Monthly Surface Skin Temperature (CERES)
Precipitation: Monthly Precipitation (GPCP)

MY NASA DATA Lessons/Activities:
Comparing Temperature and Solar Radiation for Common Latitudes (MS-ESS2-5, MS-ESS2-6)
Season Science: Building Claims from Evidence (MS-ESS2-6)
Using Vegetation and Precipitation to Study Climate Zones (MS-ESS2-5, MS-ESS2-6)
How Does the Earth's Energy Budget Relate to Polar Ice? (MS-ESS3-5)

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